CLAIMS

1. A method of identifying contours in an image comprising the steps of:

extracting features from said image;

forming chains from localized subsets of said features;

computing the values of one or more hash functions for contour segments, wherein each said contour segment comprises at least one of said chains;

identifying, using said values for said contour segments, candidate contour segments for joining;

selecting contour segments for joining from said candidates; and

joining said selected contour segments to form joined contour segments.

2. The method according to claim 1 further comprising the step of repeating said steps of identifying, selecting, and joining for additional contour segments.

3. The method according to claim 2 further comprising the step of computing additional hash functions for said additional contour segments.

4. The method according to claim 1 wherein said step of forming chains includes applying one or more chaining constraints.

5. The method of claim 1 wherein said step of selecting contour segments includes using contour constraints.

6. The method according to claim 1 wherein said step of extracting features comprises the steps of:

applying a set of filters to said image to produce a magnitude image and an angle image; and

applying truepeak and subpixel interpolation to said magnitude image and said angle image to produce said features.

7. 6
20. The method according to claim 19 wherein said features comprise edgelets.

8. 6
21. The method according to claim 19 wherein said filters comprise large oriented filters.

9. 6
22. The method according to claim 19 wherein said filters comprise Sobel filters.

10. 7
23. The method according to claim 20 wherein said step of forming chains comprises the steps of:

applying 3 by 3 connectivity and angle constraints to connect said edgelets into chains; and

11. breaking said chains into linear sub-chains. 10
24. The method according to claim 23 wherein said linear sub-chains are based on Root Mean Square (RMS) error of a line fit to subsections of said chain.

12. 10
25. The method according to claim 23 further comprising the step of discarding subchains that are shorter than a predetermined length.

13. 10
26. The method according to claim 23 further comprising the steps of discarding sub-chains that have a low average magnitude.

14. 10
27. The method according to claim 23 wherein said step of computing one or more hash functions comprises the step of computing a bounding box including all endpoints of said sub-chains.

15. 14
28. The method according to claim 27 further comprising the steps of :

constructing a spatial hash table using said bounding box and a bin size;

making said sub-chains accessible with said hash table according to spatial hash values of endpoints of each of said sub-chains.

16. 15
29. The method according to claim 28 wherein said bin size is based upon a maximum allowable gap between endpoints of sub-chains being considered for joining.

17. 15
30. The method according to claim 28 further comprising the step of identifying a seed sub-chain from said sub-chains.

18. 17
31. The method according to claim 30 further comprising the step of identifying candidate sub-chains for joining through said spatial hash table using 3 by 3 bin neighborhoods around each endpoint of said seed sub-chain.

19. 18
32. The method according to claim 31 further comprising the steps of:

computing sub-chain endpoint to endpoint distances; and

removing sub-chain candidates from consideration for joining if said endpoint to endpoint distances are not within predetermined allowable gap distances.

20. 19
33. The method according to claim 32 further comprising the steps of:

sorting candidate sub-chains by said endpoint distances; and

considering for joining said sub-chains in order according said endpoint distances wherein said sub-chains having the smallest endpoint distances are considered first.

21. 20
34. The method according to claim 33 further comprising the step of applying constraints to determine whether to join said candidate sub-chains.

22. 21
35. The method according to claim 34 wherein said constraints include a line to line angle.

23. 21
36. The method according to claim 34 further comprising the steps of:

combining said seed sub-chain with a candidate sub-chain to form an extended seed sub-chain;

removing said candidate sub-chain from consideration for further joining;

removing said candidate sub-chain from said spatial hash table; and

updating a hash value of said seed sub-chain according to end-points of said extended seed sub-chain.

37. The method according to claim 36 further comprising the steps of repeating said steps of applying constraints, combining, removing said candidate sub-chain from further consideration, removing said candidate sub-chain from said spatial hash table, and said updating step until no candidate sub-chains remain.

38. The method according to claim 37 further comprising the steps of repeating said steps including and following said step of identifying candidate sub-chains until no more candidate sub-chains are available for joining.

39. The method according to claim 38 further comprising the steps of repeating said steps including and following said step of identifying a seed subchain until no more sub-chains are available to use as a seed sub-chain.

40. The method according to claim 39 further comprising the step of:

selecting a new maximum allowable gap size; and

repeating said steps following said step of selecting a maximum allowable gap.

41. The method according to claim 14 where said joined contour segments comprise contours.

42. The method according to claim 20 wherein said step of forming chains comprises the step of applying 3 by 3 connectivity and angle constraints to connect said edgelets into chains.

43. A method of identifying scratch defects in an image of a fiber end comprising the steps of:

extracting features from said image using oriented filters;

forming chains from localized subsets of said features using 3 by 3 connectivity rules;

constructing a spatial hash table for contour segments using contour segment endpoints, wherein each said contour segment comprises at least one of said chains;

identifying, using said spatial hash table, candidate contour segments for joining;

selecting contour segments for joining from said candidates; and

joining said selected contour segments to form identified scratch defects.